

# HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

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**Hatchery Program:**

Lummi Bay Hatchery

**Species or  
Hatchery Stock:**

Fall chinook

**Agency/Operator:**

Lummi Indian Nation

**Watershed and Region:**

Lummi Bay, Whatcom County

**Date Submitted:**

November 22, 2000

**Date Last Updated:**

November 22, 2000

## **SECTION 1. GENERAL PROGRAM DESCRIPTION**

### **1.1) Name of hatchery or program.**

Lummi Bay Hatchery Summer/Fall Chinook

### **1.2) Species and population (or stock) under propagation, and ESA status.**

Chinook salmon: Samish/Mainstem Nooksack stock (*Oncorhynchus tshawytscha*).

Puget Sound ESU, Not Essential for Recovery (NMFS, 2000).

### **1.3) Responsible organization and individuals**

#### **Name (and title): Lead contact:**

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**Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:**

<b>Agency</b>	<b>Involvement</b>
WA Dept. Fish & Wildlife (WDFW)	co-manager
Nooksack Tribe	co-manager
US Department of Interior	primary funding agency

**1.4) Funding source, staffing level, and annual hatchery program operational costs.**

The facility is funded through Lummi Nation Self-Governance Program. The primary funding source is the US Department of Interior. There are three permanent employees and several part-time or seasonal employees. Annual hatchery operational costs are approximately \$ 265,000.

**1.5) Location(s) of hatchery and associated facilities.**

Lummi Bay, Puget Sound; Nooksack River Basin, Watershed Resource Inventory Area (WRIA) No.1, Sections 8, 9,10; TWN 38N; Range 1E.

**1.6) Type of program.**

Isolated Harvest

**1.7) Purpose (Goal) of program.**

The primary goal of the program is to support tribal fisheries in North Bellingham Bay and the tidally-influenced portion of the Nooksack River adjacent to the Lummi Reservation in accordance with best available science and in a manner not to impede the recovery of ESA listed species. In addition, production from this program, in concert with a similar program at the WDFW Samish Hatchery supports treaty and non-treaty fisheries in all of Bellingham and Samish Bays, and fulfills obligations under the Pacific Salmon Treaty which are essential to maintaining treaty and non-treaty fisheries in The San Juan Islands and the southern Strait of Georgia which are essential to Lummi. At present this program is dependent on the WDFW Fall Chinook Fingerling Program at Samish Hatchery to supply fry for rearing. It is a longer-range goal to develop a fully functional brood return program at Lummi Bay.

**1.8) Justification for the program.**

Justification for this program is to provide tribal harvest opportunities pursuant to rights reserved in the Treaty of Point Elliott which, absent a hatchery program, would have been lost due to habitat degradation associated with development in the Nooksack and Samish watersheds and the shoreline of Bellingham Bay. This program should not impede the recovery of listed species.

## **1.9; 1.10) List of program “Performance Standards” and “Performance Indicators”.**

**The Performance Standards for this program are:**

### **Standard A. Support Bellingham / Samish Bay fisheries.**

**Indicators are:**

- Cost-effective contribution of chinook, in conjunction with the WDFW Samish Hatchery Program, to support harvest goals;
- Annual production numbers for release at 90 to 100 per pound in late May in Lummi Bay and the tidally-influenced portion of the lower Nooksack River.
- Adequate escapement and retention of brood stock for the Lummi Bay Hatchery program to realize self-sufficiency in production within 8 years.

### **Standard B. Avoid substantial negative ecological and genetic interactions with listed fish .**

**Indicators to meet this standard are predicated on an understanding that: (1) habitat carrying capacity has been reduced through elimination of habitat and degradation of remaining habitat; and (2) data are presently inadequate to evaluate either the fate of hatchery releases or impacts to natural populations.**

**Indicators are:**

- Substantial co-occurrence of hatchery program (all hatchery sources) fish with listed fish commencing in 2002
  - on the spawning grounds,
  - in the smolt out-migration,
  - and in near-shore marine habitats.
- Substantial co-occurrence of Lummi-Bay releases with listed fish commencing in 2004:
  - on the spawning grounds,
  - in smolt out-migration
  - and in near-shore marine environments
- Better definition of potential interactions between Lummi Bay Hatchery releases and through research and monitoring studies at both generic and local population level based on co-occurrence of specific life stages of hatchery and naturally-produced fish contingent on funding. (contingent on funding).

### **Standard C. Develop and maintain an effective brood stock program which avoids new risks to the recovery of listed stocks within 8 years.**

**Indicators are:**

- Recovery of adequate quantities and qualities of brood stock to meet production to release

goals as indicated by an increase in returns of program fish to the hatchery consistent with program and facility modifications;

- Adherence to co-manager spawning guidelines for selection, mating, and incubation;
- Use of carcasses to supplement ecosystem nutrients consistent with co-manager approved protocols.

#### **Standard D. Avoid Over-Harvest of Listed Stocks.**

**Indicators are predicated on co-manager guidelines (see Section 3.)**The Co-Manager harvest management plan for Nooksack fall chinook has taken into consideration the overlap which might occur with late migrating fish from the North Fork and South Fork chinook stocks which require protection and early migrating fall chinook from the hatchery production which could be harvested. The opening of the fall fishery has been deferred until the first week of August to protect native stocks until such time as a selective fishery which might take hatchery chinook without harm to native chinook can be developed, or until such time as the native chinook can tolerate the exploitation rates which might occur during this overlap.

- The August start date for the chinook fisheries, after the reported time of upstream migration of listed Native Char, in addition of the 6+ -inch minimum gill net restriction should eliminate and incidental catch of the listed Native Char.

#### **1.11) Expected size of program.**

##### **1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).**

The Lummi Bay Hatchery attempted to establish a broodstock recovery program in the early 1980s. Early returns were encouraging, but for reasons unknown returns to the Hatchery have not been sufficient to produce significant numbers of eggs. Efforts are being undertaken to develop features at the Hatchery which will improve its ability to attract returning adults. The Hatchery does not currently (spawn but will institute spawning as soon as the numbers of returning adults justify it.

Size of the future broodstock program is anticipated to be recovery of an average of 1500 (670 females) summer/fall chinook or sufficient broodstock to meet fry rearing goals.

**1.11.2) Proposed annual fish release levels (maximum number) by life stage and location**

Life Stage	Release Location	Annual Release Level
Eyed Eggs	-	-
Unfed Fry	-	-
Fry		
Fingerling	On-Station	500,000 - 1,000,000
	Lower Nooksack	500,000 - 1,000,000
Yearling	-	-

**1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.**

Estimates of smolt-to-adult survival program performance for Lummi Bay Hatchery have not been calculated since the termination of the CWT program in 1995. Releases between 1985 and 1994 were included as a part of the Mainstem Nooksack/Samish Hatchery Indicator Stock for the Pacific Salmon Treaty (PST). The CWT program will be reestablished by 2002 to ensure more detailed information on the contributions of program releases on the target fisheries. A new program will be initiated (see Section 11).

**1.13) Date program started (years in operation), or is expected to start.**

The chinook program began in 1978.

**1.14) Expected duration of program.**

The hatchery is expected to continue its operations into the foreseeable future or until such time as habitat recovery provides surplus production sufficient to meet treaty- right fisheries obligations.

**1.15) Watersheds targeted by program.**

Bellingham Bay and the tidally-influenced portion of the Nooksack River (WRIA 01).

**1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.**

The co-managers have made many adjustments in the combined programs to promote recovery of listed chinook and provide harvestable surplus to support terminal area fisheries.

- The Kendall hatchery program has been established as an egg bank for the North Fork Chinook stock to ensure that there is sufficient adult abundance to support rebuilding when spawning and rearing habitat conditions permit.

- Releases of hatchery summer fall Chinook into the non-tidal sections of the Nooksack River have been eliminated to reduce possible competition during rearing and seaward migration of the native early chinook stocks.
- Releases of hatchery summer fall chinook in the northern portions of Bellingham Bay have been reduced from 9,000,000 fed fry to no more than 2,000,000 to reduce possible competition during the seaward migration of the native early chinook stocks.
- The release of yearling coho from the Lummi Skookum Creek Hatchery program has been reduced from 4,000, 000 to 2,000,000 fish to reduce potential competition and predation between hatchery produced coho and natural origin chinook.

The Co-managers are constantly evaluating their harvest and hatchery programs in the area to increase the returns of adults to the fisheries with a minimum cost and protection of listed stocks to ensure that recovery will not be impeded. The Monitoring Plan in Section 11 will serve to evaluate these early actions. The possible use of net pens to serve the present rearing function performed at the Lummi Bay Hatchery has also been discussed but not implemented. However, this would not address the need for development of a brood stock program.

## **SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.**

- 2.1) List all ESA permits or authorizations in hand for the hatchery program.**  
There are no ESA permits or authorizations at this time.

- 2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.**

**2.2.1) Description of ESA-listed salmonid population(s) affected by the program.**

**- Identify the ESA-listed population(s) that will be directly affected by the program.**

No ESA-listed populations are directly affected by the program.

**- Identify the ESA-listed population(s) that may be incidentally affected by the program.**

Five indigenous salmonid stocks listed as Threatened under the ESA occur in the greater Nooksack Basin, and may occur in other unconnected basins in WRIA 1.

These stocks are: North Fork Nooksack chinook; South Fork Nooksack chinook (WDF 1993); and three bull trout/Dolly Varden stocks(WDFW 1998).

The Upper Middle Fork Nooksack bull trout/Dolly Varden stock is a resident stock, isolated from anadromous migration by the presence of an impassible water diversion dam on the Middle Fork Nooksack. This stock is isolated from Lummi Bay Hatchery operation and thus is not likely to be "incidentally affected" by the program.

The following ESA-listed fish may be incidentally affected by the program primarily during residence times in near-shore habitats:

**Chinook ((*Oncorhynchus tshawytscha*))**

North Fork Nooksack stock

South Fork Nooksack stock

**Bull trout/Dolly Varden (*Salvelinus* sp.)**

Lower Nooksack stock

Canyon Creek stock

**-Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.**

Life stage productivity data for the South Fork Nooksack spring chinook is limited. Most information dates prior to 1992 when the Skookum Creek Hatchery CWT Program was discontinued due to cessation of hatchery production. Limited empirical data on the South Fork Nooksack spring chinook survival and relative abundance is provided in the Skookum Creek Hatchery HGMP.

The WDFW Nooksack Hatchery draft HGMP reports smolt-to-adult survival rates of 0.38 to 1.473% between 1988 and 1995 for the North Fork chinook hatchery stock which is a PSC indicator stock for the North Fork early chinook.

**- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.**

The annual spawning abundance data in the following table are the best available at this time. The data and estimation process are currently under review to determine whether determinations with respect to origin of estimated spawners can be improved.



Table 1. Estimated escapement of native Nooksack chinook stocks.

YEAR	SOUTH FORK CHINOOK	NORTH FORK CHINOOK		
	Mixed or Unknown Origin	Mixed or Unknown Origin	Native	Cultured
1984	188	45		
1985	445	255		
1986	170	224		
1987	248	179		
1988	233	452		
1989	606	300		
1990	142	10		
1991	365	107		
1992	103	493		
1993	235	445		
1994	118	45		
1995	290	228*	175*	53*
1996	203	538*	210*	328*
1997	180	621*	121*	500*
1998	157	366*	39*	327*
1999	213	911*	91*	820*
2000*	N.A.	1235*		

\*Provisional

Abundance data is not available for Nooksack basin bull trout/Dolly Varden.

**- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.** There are no data relating annual proportions of Lummi Bay Hatchery releases and natural-origin fish on the natural spawning grounds. Empirical data available on the proportions of natural-origin and hatchery-origin chinook (**all sources**) are provided in the spawning escapement table above.

Mass marking programs instituted by the Lummi Nation and WDFW in the 2000 Brood Year will identify hatchery-origin fish on the spawning grounds in future years. Increased sampling of the spawning populations in the region and possible expansion of the otolith marking system for all hatchery production from the Nooksack/Samish region will allow a more accurate estimate of the relative proportions of natural origin spawners, and cultured origin spawners by hatchery. This will allow investigation of the factors affecting straying of hatchery production to unwanted areas and potential correction of hatchery practices to eliminate this straying.

It is expected that the reduction of hatchery summer fall chinook production releases in the non-tidal portions of the Nooksack River will have a significant impact on the straying of summer/fall hatchery production in the North Fork and South Fork early chinook spawning

areas. Planned mass marking and increased sampling of spawning chinook populations in the region will provide data to evaluate this assumption.

**2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take.**

**Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.**

- The Lummi Bay Hatchery might possibly take listed salmonid juveniles during operation of its tide gates. Tide gate operation has the potential to entrap, injure, or directly kill young fish forced against gates during high flows. There is no evidence available of chinook or char juveniles in the region of the tide gates. Given the small area affected by the tide gates relative to potential salmonid habitat, the lack of estimates of native chinook or char in Lummi Bay or in the vicinity of the tide gates, the likelihood of mortality of listed salmonid populations is very low.
- The release of fingerling chinook could increase the competition for resources in the near shore marine environments if that habitat is limiting the survival of listed stocks. There are currently no useful estimates of the amount of interaction between the hatchery summer fall releases and listed salmonids in the near shore marine habitat, nor the limitations on salmonid survival due to conditions in the near shore marine environment which might be exacerbated by hatchery chinook production. The co-managers have addressed this issue with the reduction of the releases of summer fall hatchery production in Bellingham Bay. Funding is being sought to inventory and evaluate the use of the near shore and estuarine habitat in the region by salmonids. The risk of a take due to this factor, based on available information, is low, and the takes are likely to be negligible.
- It is possible that some of the listed salmonids may incidentally be taken in the fisheries targeting adult summer fall hatchery production in the region during the period of August and early September. Co-manager actions to delay the start of this fishery until after the bulk of the upstream migration of the listed salmonids has reduced the potential for incidental take of North Fork and South Fork early chinook to negligible levels. Incidental take of listed salmonids from other portions of the ESU is negligible or undetectable by GSI analysis. Re-establishment of the CWT tagging of the Lummi summer/fall chinook production, mass marking programs and improved catch sampling programs will allow better estimation of the take of listed salmonids, if any.

**- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.**

The nature and extent of past take events is unknown because it has not been possible to easily distinguish between hatchery fall chinook and native North and South Fork Nooksack chinook. Mass marking programs instituted in the 2000 Brood Year should rectify this situation.

**- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**

"Zero" annual takes are projected for the Lummi Bay Hatchery. The facility operates outside of the river system and has limited chinook adult collection that takes place after the peak spring chinook run.

Hatchery fall chinook run timing does coincide with bull trout/Dolly Varden upstream migration. However, it is unlikely that bull trout would be attracted to the Sea Ponds holding areas. No bull trout/Dolly Varden have been trapped or observed during the period the facility has been in operation (Hall pers. comm.).

Juveniles of listed species may rarely be entrapped in net pens and tide gates. But estimating a given annual take level for this eventuality is impractical.

**- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.**

Because of no known take events at the Lummi Bay Hatchery, there are currently no contingency plans to address take issues on listed fish. However, a written Standard Operating Procedure (SOP) Manual will address any unanticipated situations where take is likely to occur. Language in the SOP will state that whatever operational activity that is causing, or may potentially cause, take of a listed species should cease immediately. Any rectifying actions (such as repairing faulty equipment) should be undertaken without delay.

### **SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES**

- 3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NPPC Annual Production Review Report and Recommendations - NPPC document 99-15*). Explain any proposed deviations from the plan or policies.**
- There is currently no ESU-wide hatchery plan. Lummi has agreed in principle with the Joint Wild Stock Policy adopted by the Washington State Fish and Wildlife Commission and implements this program under the requirements of the policy.

**3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. . Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.**

This program operates under the applicable orders of U. S. v. Washington (US District Court Western District of Washington No. 9213) the Boldt Decision. The Puget Sound Salmon Management Plan (US v. Washington No. 9213 (85-2) (PSSMP) provides for an agreed Equilibrium Brood Document. The Nooksack Samish Region Equilibrium Brood Document was last updated in 1993.

The Washington State Department of Fish and Wildlife, the Nooksack Tribe and the Lummi Nation entered into a Memorandum of Understanding on November 1, 1994 outlining a co-management approach to the recovery of native chinook salmon in the Nooksack watershed. The Co-Managers, in their approval of a draft "Recovery Plan for Chinook Salmon in Water Resources Inventory Area No. 1 (WRIA 1)" in 1999, have agreed to modifications of the Nooksack Samish Equilibrium Brood Document as they apply to native chinook stocks of the Nooksack watershed. The Equilibrium Brood Document will be revised as time permits, but the modifications are allowed under the PSSMP by mutual agreement.

This program is also integrated into the Pacific Salmon Treaty process for cooperative management of fisheries and enhancement programs to provide optimum production and to receive benefits equal to production originating in its waters.

Salmonid disease control policy of the fisheries co-managers of Washington State of 1998 is followed.

The current plans are subject to modification by agreement as new information is developed to indicate that mutual objectives would be better served by modifications.

This program will be operated in a manner consistent with these plans and commitments.

The program will also comply with the Comprehensive Chinook and Comprehensive Coho Management Plans which are being developed by the Boldt Area Tribes and the Washington Department of Fish and Wildlife.

**3.3) Relationship to harvest objectives.**

The production from this facility is an important component of the co-managers program to provide for a meaningful harvest opportunity in the Nooksack Samish Terminal |Area fishery in part to tribal fishers pursuant to rights reserved in the Treaty of Point Elliott which would have been lost due to habitat degradation associated with development in the Nooksack and Samish watersheds and the shoreline of Bellingham Bay as well as to

reduce incidental impacts on chinook stocks of concern in pre-terminal fisheries. The harvest management plan for the Area is based upon the expected return of the hatchery production.

The production of this program is harvested under the Puget Sound Salmon Management Plan as the Nooksack Samish Terminal Area primary hatchery management unit. Run reconstruction procedures currently in use estimate the contributions on the basis of the number of returning chinook to the facility, rather than CWT recovery information. CWT's have not been applied in recent years, but on the basis of data from earlier years, the contribution rate per smolt released should be equal to or greater than the contribution rate of the smolts released from the Samish hatchery which continue as part of the PST indicator stock program. The chinook released from the sea ponds do not return in large numbers to the release facility. A similar situation seems to apply to the releases from the Mamoya Pond facility.

The Lummi harvest objectives for the Nooksack Samish Terminal Area are to have a 5-day per week tribal fishery for chinook from the first of August until the 2<sup>nd</sup> week in September. This will provide for a modest income as well as a source of fish for ceremonial and subsistence use. Since the Nooksack Samish Terminal area is a primary hatchery management unit under the PSSMP, the production from this hatchery, in concert with the WDFW Samish Hatchery, is essential for maintaining this facility.

Pursuant to agreements with the WDFW, in 2000, fish from this facility have had their adipose fins removed to allow easy identification of hatchery fish. This is done in case it is possible to conduct a catch and release selective sport fishery targeted on chinook in the future without undermining the PSC indicator stock CWT program.

The Co-Manager harvest management plan for Nooksack fall chinook has taken into consideration the overlap which might occur with late migrating fish from the North Fork and South Fork chinook stocks which require protection and early migrating fall chinook from the hatchery production which could be harvested. The opening of the fall fishery has been deferred until the first week of August to protect native stocks until such time as a selective fishery which might take hatchery chinook without harm to native chinook can be developed, or until such time as the native chinook can tolerate the exploitation rates which might occur during this overlap.

We have no information to suggest that there is any impact of the Nooksack Samish Terminal Area fisheries on the Hood Canal or Strait of Juan de Fuca summer chum stocks.

### **3.4) Relationship to habitat protection and recovery strategies.**

As an isolated harvest program with releases directly into marine and estuarine areas, this program seeks to avoid the major freshwater production bottlenecks which almost all of

the habitat protection effort and related production benefits in the Nooksack are designed to address. These include issues related to riparian function (lack of in stream wood, excessive sedimentation, shade and confinement by levees, as well as pools, off-channel, and spawning habitat. Since the early marine life history for the Lummi Bay Hatchery population is virtually unknown, including the timing and distribution of out-migration through the region, it is impossible at this time to define the requested relationship. The Coded-Wire-Tag marking program planned for Lummi Bay Hatchery releases should help in better identifying the necessary geography. Otolith marks might be used in the future to allow more precise information of sample composition of chinook by natural or cultured origin and if cultured, from which facility. A major effort aimed at integrated sediment management is underway in Bellingham Bay (the Bellingham Bay Pilot Project) and sampling associated with that program may help to define the relationship to Lummi Bay Hatchery chinook.

**3.5) Ecological interactions.**

Given the paucity of information on the timing of the distribution and abundance of Lummi Bay Hatchery chinook, specific interactions are very speculative at this point. There is a need to improve information on the generic understanding of the potential interactions in systems similar to the present one. Six species of salmonid fishes have been identified in the near-shore habitats of Bellingham and Lummi Bay, using beach seines and towed nets (Sjolseth et al. 1968, Ballenger 1996). They are: chinook salmon, coho salmon, chum salmon, pink salmon (even years only), bull trout/dolly varden, and steelhead. Peak chinook smolt abundance occurred in June and July, which coincided with peak herring larval abundance, but was later than peak coho and chum smolts abundance which occurred in April and May (Ballenger 1996). Data refinement is needed to address interactions in cases where over-lap of occurrence is observed.

## **SECTION 4. WATER SOURCE**

**4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.**

The freshwater source for the Lummi Bay chinook program is drawn from Kwina Slough (Slough RB at RM 1.65, Nooksack River) and pumped by two 25 h.p. pumps to a reservoir on Chief Martin Road. From there it passes through a pipe by gravity to the hatchery. Peak hatchery use is about 350 gpm in May. Water quality parallels Nooksack River water quality except that as air temperature warms through the spring and summer, both the slough and Chief Martin reservoir have less temperature buffering quality than the river itself resulting in much warmer rearing pond temperatures. Freshwater quantity from this source is the principal factor limiting production of chinook at the facility. Seawater, and seawater-freshwater mixes are used in the final rearing stage for the present chinook production.

Future utilization of the facility for spawning and incubation will require two other considerations involving water source: freshwater attraction of adults; and water for incubation. The Lummi Nation has acquired funds to extend the hatchery intake line approximately 0.7 mile from the Kwina Slough pump station to a new location on the Nooksack River. This action is essential to meet the standard of a self-sufficient brood program in eight years. This move will not change the source character of the water being supplied to the hatchery but will substantially increase the reliability of supply. The intake will be provided with screens meeting federal agency requirements. The present intake is screened and has **not resulted in the take of listed species**. This modification **will not increase the likely-hood of take of listed species**.

Attraction water for coho salmon at Lummi Bay facility comes from discharge from the east tide gate of the Lummi seapond. This is principally a marine source with minimal freshwater contribution. It has worked very well for coho attraction and the facility has been an effective brood recovery station for nearly twenty-five years. Attraction of chinook has met with inconsistent success but utilization of a higher freshwater component in the attraction water seems to be necessary. Freshwater quantity presently is inadequate for this purpose.

The Lummi Bay facility has been used for incubation of chinook, coho and chum salmon in the past. However, the quality of water has never been suitable for this purpose because during incubation periods the water has a high silt content and in extreme winter conditions, freezes. These problems were inadequately addressed by indoor re-circulation and filtration in the past. More recently, the Lummi Nation has incubated coho and chum eggs at a satellite facility on Sandy Point. This facility has a pumped well water supply of about 100 gallons per minute and would be a suitable incubation site for chinook salmon in the future.

The Lummi Bay Hatchery applied for a National Pollutant Discharge Elimination System (NPDES) permit in 1998. Application for the permit is still pending.

The Environmental Protection Agency (EPA) is developing a general permit for "Tribal Hatcheries and Other Upland Aquaculture Facilities in the State of Washington", that will provide standard guidelines for monitoring total and suspended solids in hatchery effluent and other parameters. The Lummi Bay Hatchery will apply for the general permit when it becomes available.

**4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.**

The fresh water intake on Kwina Slough is fitted with a stainless steel perforated plate screen that conforms to WDFW screening guidelines (1998) for avoiding entrainment of juvenile fish. The tide gate intakes for the salt water rearing and holding ponds are screened in a similar manner.

## **SECTION 5. FACILITIES**

### **5.1) Broodstock collection facilities (or methods).**

At present, a small number of adults return to a 1.5 acre earthen pond that leads to a 8 X 35' concrete raceway (Figure 2) and are not used as brood. From the raceway they are collected by dip net and killed. Two approaches to successful brood collection in the future will depend upon additional funding. These are: increase in the primary freshwater supply with utilization of the existing facilities; and/or, an increase in the capture efficiency of chinook returning to the proximity of the facility in Lummi Bay by construction of weirs, holding pens or nets.

### **5.2) Fish transportation equipment (description of pen, tank truck, or container used).**

At present there is transport of fed fry (approximately 1,000,000 at 600 per pound from the Maritime Heritage Hatchery (Bellingham Bay) and transport of fingerlings (approximately 500,000 from the Lummi Bay facility to the Marine Drive Bridge on the lower Nooksack River for release. Transit time is approximately 30 minutes. Free-swimming fish are transported to and from the hatchery by a truck loaded with a 1,000 gallon aluminum tank. Water is circulated in the tank with a recycle pump. Fry and smolts are in-solution vaccinated for *Vibrio* ( *Vibrio anguillarum* ) and Bacterial Kidney Disease *Renibacterium salmoninarum* ) during transport.

### **5.3) Broodstock holding and spawning facilities.**

There is no broodstock collection program for fall chinook at Lummi Bay hatchery. An earth-lined sea pond of approximately 1/2 acre is used to hold returning adult fall chinook..

### **5.4) Incubation facilities.**

There is no incubation program for fall chinook at Lummi Bay Hatchery. Incubation facilities will be provided at the Sandy Point facility or at Lummi Bay when required.

### **5.5) Rearing facilities.**

- First stage rearing (600/lb to 200/lb) is in four circular concrete ponds, 40 feet in diameter, and four feet deep supplied with fresh-water. An initial lot (500,000) is marked (adipose clip and proposed CWT) and moved to final rearing. A second lot (500,000) is then introduced into the first stage rearing facility.

- Final rearing (200/lb down to 90/lb) for the first lot is in a 0.5 acre earthen pond, supplied with a fresh-water/seawater mix.

- **5.6) Acclimation/release facilities.** First lot fish are acclimatized in the final rearing pond and volitionally released into Lummi Bay.
- Second lot fish are marked and evaluated and finish reared in the circular ponds. They are transported for direct release into the Nooksack River below the Marine Drive



bridge.

**5.7) Describe operational difficulties or disasters that led to significant fish mortality.**

A recurring problem at this facility is excessive water temperatures in the earthen ponds on sunny spring days (Hall pers. com.). Temperatures have approached 65° F --a level that is lethal to juvenile salmonids. On occasions it has been necessary to "emergency release" chinook fry into Lummi Bay to avoid mortality.

Attempts to provide extended acclimation periods for chinook in the earthen ponds has resulted in outbreaks of *Vibrio anguillarum* disease with attendant mortality.

**5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.**

Listed natural fish are not reared in the facility and would be unaffected by water loss or equipment failures.

The hatchery is staffed around the clock. A manual start back up generator is available in the event of power outage. Alarm systems alert operators in the event of pump failure at Kwina Slough pump station, power failure at the hatchery, or low water failure in the rearing ponds.

Pre-arranged contingency plans will be developed between hatchery co-managers in the Nooksack and Samish basins. These plans need to be at the ready, should emergency transfer of eggs or fish need to be undertaken on very short notice.

The possibility of disease transmission is minimized through implementation of the co-manager disease control policy. The hatchery is one of several facilities in the Nooksack Fish Health Management Zone (FHMZ). FHMZ's are defined as: "*a geographic area containing one or more watersheds draining into the same bay or estuary from the transfer of live fish, eggs, or gametes are regulated. All surface water supplied facilities located within the FHMZ are included in the FHMZ*".

Fry are sampled for viral and bacterial pathogens on a twice-monthly basis. Sampling procedures are as specified in the Fish Disease Control Policy. Northwest Indian Fisheries Commission (NWIFC) pathologists perform the sampling. Specimens are sent to contract laboratories for analyses.

Current operational policy at the hatchery specifies that only healthy fish are released into the wild (NWIFC and WDFW 1998). Fish exhibiting signs of disease are treated with

the appropriate medication, at the recommended rate and manner of application. Fish that die or fail to respond to treatment are disposed in a landfill (Hall pers, comm.).

## **SECTION 6. BROODSTOCK ORIGIN AND IDENTITY**

**Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.**

### **6.1) Source.**

Samish/Mainstem Nooksack chinook. The present-day stock is non-native and is sustained primarily by hatchery production, with some wild spawning (WDF et al 1993). The status of the stock is "Healthy" (WDF et al. 1993). The stock is not included in the hatchery stocks listed under the ESA as "Threatened" in the Puget Sound ESU. And it is not deemed "essential to recovery" for Puget Sound chinook.

The original stock derived from the Green River and has been propagated in the Samish Hatchery (WDFW) since the early 1900's (BIA 1999). There is no record of native fall chinook in the Samish River basin or a native fish component in the founding broodstock (BIA 1999, Tygeson pers. com.).

The Maritime Heritage Center (Nooksack Regional Enhancement Group) used a Deschutes River fall chinook stock in 1982 (WDF "Program PLO2" 1989). They used a summer/fall chinook from the Clark Creek Hatchery (WDFW) in 1983. The Clark Creek stock is native to the Skagit basin (WDF et al. 1993, BIA 1999). However, the net genetic contribution of these two introductions to the Samish/Mainstem Nooksack chinook stock is probably negligible.

Currently, Samish/Mainstem chinook are produced at the WDFW Nooksack Hatchery, Samish Hatchery, Lummi Nation Lummi Bay Hatchery (rearing only), and Maritime Heritage Center. The management goal for Lummi Bay Hatchery is "Isolated Harvest".

### **6.2) Supporting information.**

#### **6.2.1) History.**

This information is provided in Section 6.1 above.

#### **6.2.2) Annual size. /6.2.3) Past and proposed level of natural fish in broodstock.**

No naturally spawning fish have been incorporated into this broodstock for two decades. And there is no plan to introduce naturally spawning stock in the future.

#### **6.2.4) Genetic or ecological differences.**

Limited wild production occurs in this stock throughout Watershed Resource Inventory Area (WRIA) No. 1. Spawner surveys conducted since the 1940's

found late spawning chinook salmon (October through December) in the mainstem Nooksack; North, South, and Middle Forks; and major tributaries to these rivers. Fall spawners are also found in Dakota Creek. Native stocks of fall chinook are probably extinct in the Nooksack River basin. Genetic or ecological differences between naturally-spawning fall chinook and hatchery fall chinook are unknown; however, planned sampling of spawning populations for tissue DNA should allow looking at this question.

**6.2.5) Reasons for choosing.**

Fall-run chinook were originally chosen to provide to provide tribal harvest opportunities pursuant to rights reserved in the Treaty of Point Elliott which would have been lost due to habitat degradation associated with development in the Nooksack and Samish watersheds and the shoreline of Bellingham Bay without impeding the recovery of native species.

**6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.**

The hatchery location and period of operation avoids capture of listed fish.

## **SECTION 7. BROODSTOCK COLLECTION**

The hatchery does not have a chinook broodstock collection program. Broodstock, whose progeny will eventually be reared at Lummi Bay, are collected at the Samish Hatchery operated by the WDFW. Broodstock identity and collection procedures are outlined in the WDFW Samish Hatchery HGMP.

**7.6) Fish transportation and holding methods.**

Fish transportation is described in Section 5.2. Broodstock are not transported.

The Lummi Bay Hatchery has a number of holding areas and pens. An earth-lined sea pond of approximately 1/2 acre is used to hold returning adult fall chinook. Adults are then directed into step-up weirs and then into rectangular raceways, where they are sorted and killed.

**7.7) Describe fish health maintenance and sanitation procedures applied.**

Three pathogens are regularly detected: Cold Water Disease (*Flavobacterium psychrophylus*), Bacterial Gill Disease (*Flavobacteria* spp.) and Bacterial Kidney Disease (BKD, *Renibacterium salmoninarum*). BKD may be vertically transmitted from female to offspring. Cold water disease and bacterial gill disease are treated with Terramycin medicated feed. BKD is treated with erythromycin medicated feed. See also Section 5.8.

**7.8) Disposition of carcasses.**

Adults returning to the Lummi Bay Hatchery are killed and sold for crab bait. The small numbers involved make developing a stream re-seeding program impractical at this time.

## **SECTION 8. MATING**

**Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.**

The Lummi Bay Hatchery does not currently have a chinook broodstock collection or mating program. Mating protocols affecting the chinook reared at Lummi Bay occurs at the WDFW Samish River Hatchery. Details of the WDFW mating procedures are found in their HGMP. The future broodstock program at Lummi Bay will follow the mating guidelines utilized by WDFW and adopted by the co-managers.

## **SECTION 9. INCUBATION AND REARING -**

**Specify any management goals (e.g. “egg to smolt survival”) that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.**

**9.1) Incubation:**

Fall chinook egg incubation takes place at the Samish Hatchery operated by the WDFW. See Section 8.

**9.2) Rearing:**

**9.2.1) Provide survival rate data by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available..**

Precise survival rate data is unavailable. In routine years, mortality from fry to fingerling stage is estimated to be 0.1% (Hall pers. comm.). Most mortality occurs during transport.

Intermittent outbreaks of *Vibrio (Vibrio anguillarum)* disease have resulted in the loss of 500 to 600 fish annually, for an additional 0.01% mortality.

**9.2.2) Density and loading criteria (goals and actual levels).**

Each circular rearing pond can accommodate up to 125,000 fry. Preferred loading is 100,000 fry per pond. The 0.5 acre salt water acclimation pond is adequate for current densities of 500,000 to 1,000,000 fingerlings. Fresh water supply is limiting and needs improvement.

**9.2.3) Fish rearing conditions**

Fresh and salt water rearing pond temperatures are measured once a week, or more often

if hot weather is a concern. Fresh water temperatures typically range between 40-45°F.

Dissolved oxygen (DO) is measured daily in the circular rearing ponds. The minimum acceptable DO level is 5.5mg/l. Typical DO at release time is 7.0 -7.5mg/l.

Fish are visually monitored for health at each feeding.

**9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.**

For available data in 1998, percentage daily growth rates ranged from 4.72 to 5.74 over a 29 day period in the four circular rearing ponds. (March 23-April 21, 1998)

For 1999, an overall percentage daily growth rate for the four ponds was 5.91 percent over a 22 day period. (April 21-May 13). The slightly higher computed growth rate for 1999 as compared to 1998 is consistent with slightly higher temperatures which would be expected due to the later season.

**9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.**

Energy reserve data not available.

**9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).**

All hatchery fish are fed "Nutri-Plus", manufactured by Moore Clark Corporation of Portland, OR. The facility uses an average of 9,000 lbs of feed monthly. Although data on daily feeding rates are not available, the percentage daily growth rates indicated in Section 9.2.4 are consistent with targeted feeding rates of 5% a day and feed conversions of a little more than 1.

**9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.**

See Section 5.8.

**9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.**

Not available.

**9.2.9) Indicate the use of "natural" rearing methods as applied in the program.**

For the fall chinook program, the only "natural" rearing treatment is residence in the salt water holding pond. This pond receives continuously cycled, unfiltered and untreated, marine water and there are opportunities for feeding on natural prey carried in those waters. Some invertebrate production may also occur in the earthen substrate of the pond.

**9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.**

The program does not propagate listed fish.

## **SECTION 10. RELEASE**

**Describe fish release levels, and release practices applied through the hatchery program.**

**10.1) Proposed fish release levels.** *(Use standardized life stage definitions by species presented in Attachment 2. "Location" is watershed planted (e.g. "Elwha River").)*

<b>Age Class</b>	<b>Maximum Number</b>	<b>Size (fpp)</b>	<b>Release Date</b>	<b>Location</b>
<b>Eggs</b>	-	-	-	-
<b>Unfed Fry</b>	-	-	-	-
<b>Fry</b>				
<b>Fingerling</b>	2,000,000	90/lb	mid-to late May	(1) Lummi Bay (50%)  (2) lower Nooksack mainstem (50%)
<b>Yearling</b>				

**10.2) Specific location(s) of proposed release(s).**

Approximately ½ the fingerlings are released at each location.

### **Location 1.**

**Stream, river, or watercourse:** *(include name and watershed code (e.g. WRIA) number)*  
Lummi Bay, WRIA No. 1

**Release point:** *(river kilometer location, or latitude/longitude)* Lummi Sea Ponds, Main Facility

**Major watershed:** *(e.g. "Skagit River")* NA

**Basin or Region:** *(e.g. "Puget Sound")* Puget Sound

### **Location 2.**

**Stream, river, or watercourse:** Nooksack River mainstem, WRIA No. 1

**Release point:** Marine Drive Bridge, RM 1.5

**Major watershed:** Nooksack River

**Basin or Region:** Puget Sound

**10.3) Actual numbers and sizes of fish released by age class through the program.**

See Table 4.

**10.4) Actual dates of release and description of release protocols.**

Table 4. Fall chinook release dates, locations, and life stage. Data are from NWIFC "CRAS (Coded-Wire-Tag Retrieval and Analysis System)" database and current year observation.

Date(s)	Location	Number	Life Stage	Size (fpp)
6/1/88	Lummi Bay	957,330	fingerling	81
6/15/88	Lummi Bay	402,344	fingerling	87
6/10,7/15/1988	Lummi Bay	32,000	yearling	10
5/30/89	Lummi Bay	1,300,000	fingerling	70
6/5/89	lower Nooksack	116,900	yearling	11
5/30/91	Slater Slough	1,100,000	fingerling	81
6/1-3/92	Lummi Bay	1,000,000	fingerling	103
5/28/93	Slater Slough	240,000	fingerling	119
5/22-25/93	Lummi Bay	881,729	fingerling	91
4/4/94	lower Nooksack	1,056,000	fry	324
5/25/94	lower Nooksack	2,000,000	fingerling	115
5/15,23/94	Lummi Bay	2,073,028	fingerling	91
3/30/95	lower Nooksack	1,008,090	fry	87
5/19,23/95	Lummi Bay	906,046	fingerling	93
5/16/96	Lummi Bay	744,000	fingerling	101
5/19-20/97	Lummi Bay	613,940	fingerling	99
5/8/98	Lummi Bay	1,500,000	fingerling	85
NA/1999	Mamoya Pond	1,500,000	fingerling	90
NA/1999	Lummi Bay	500,000	fingerling	90
5/11/00	Lummi Bay	NA	fingerling	NA
5/18/00	lower Nooksack	450,000	fingerling	NA

Release is volitional from Lummi Bay Sea Ponds, no additional forcing is required. Release to other locations is forced, but occurs at the same time as volitional behaviors are observed.



**10.5) Fish transportation procedures, if applicable.**

Fish are transported by tank truck (described in Section 5.2) to the lower Nooksack release point. Transit time is approximately 30 minutes.

**10.6) Acclimation procedures (*methods applied and length of time*)..**

Fall chinook fry at about 600 fish/lb are received from Maritime Heritage Hatchery or WDFW Bellingham Hatchery in early March. Beginning the first of April, sea water is gradually added to rearing ponds. Acclimated fish are released in mid-May.

**10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.**

The Sea Ponds fall chinook program now utilizes mass marking techniques. Beginning in Brood Year 2000 all hatchery-reared fish will be adipose fin-clipped prior to release and/or receive uniform otolith marks.

Beginning in 2001, sufficient releases will be coded wire tagged to provide statistically valid estimation of the proportions of each Lummi Bay and Lower Nooksack River chinook release contributing to the fisheries, and evaluation of release strategies.

**10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.**

No significant stock surpluses have occurred. Low mortality rates at the facility negate the need to raise surplus fish. Minor overruns of approved levels under the Equilibrium Brood Document are released with the rest of the fish.

**10.9) Fish health certification procedures applied pre-release.**

Fish health status is monitored on a twice-monthly basis under a certification program overseen by the NWIFC. Monitoring dates may or may not coincide with the immediate pre-release period. Hatchery personnel receive regular training and in services to identify overt signs of disease in fish of various life stages.

**10.10) Emergency release procedures in response to flooding or water system failure.**

The Lummi Bay Hatchery has no formalized emergency release procedures in response to water-related emergencies.

The most common emergency is excessive temperatures and deficient oxygen in the earthen pond. When this occurs fry or fingerlings are immediately released into Lummi Bay. Past weather-related emergencies been handled on site and no emergency releases resulted. An Emergency Release Contingency Plan is a high priority for inclusion in a proposed hatchery operation SOP.

**10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases**

Fall chinook fingerlings are released into the Nooksack near its mouth, or into marine waters. The intention is that hatchery stock will be imprinted to the lower basin and near-shore waters to be available for a minimal-escapement fishery.

Hatchery fingerling interaction with pre-smolt juveniles of listed stocks is avoided through greater than 20 River Miles separation between the release point and known rearing areas of the listed stocks.

Smolt out-migration of North and South Fork Nooksack chinook occurs during the same period as the Lummi Bay and Lower Nooksack River hatchery fingerling release, but, negative effects to the listed fish are expected to be minimal due to the minimum overlap in time and space.

**SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS**

*This section describes how “Performance Indicators” listed in Section 1.10 will be monitored. Results of “Performance Indicator” monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet “Performance Standards”.*

**11.1) Monitoring and evaluation of “Performance Indicators” presented in Section 1.10.**

The Lummi Nation Natural Resources Department, in conjunction with the salmon co-managers, conducts a comprehensive program of research and monitoring of ecological parameters affecting the production and survival of salmonids in WRIA 1). This program is integrated throughout the greater Nooksack Basin and western Whatcom County and is not directly associated with any particular artificial production facility. Take considerations for these activities are addressed under other portions of the 4(d) rule (NMFS, 2000). Funding considerations for these activities are briefly discussed in Section 11.1.2.

Monitoring to meet the indicators outlined in Section 11.1.1 consists of:

(1) implementation; (2) effectiveness; and (3) validation elements consistent with the co-managers comprehensive chinook recovery plan.

**11.1.1) Describe plans and methods proposed to collect data necessary to respond to each “Performance Indicator” identified for the program.**

**Standard A. Support Bellingham / Samish Bay fisheries.**

**Indicator 1. Cost-effective contribution of chinook, in conjunction with the WDFW Samish Hatchery Program, to support harvest goals.**

**Implementation** monitoring to determine whether the following activities actually occur according to the proposed schedules. Planned activities are dependent on achievement of adequate funding and include: (1) continued mass-marking by adipose removal or otolith mark of all hatchery program summer fall chinook (this has been achieved for the 2000 brood year for the Lummi Bay Hatchery program.); (2) Application of mass marks, currently 200,000 CWTs to each of the Lummi Bay Hatchery release groups commencing in brood year 2001 are planned. (3) Improved catch sampling in the Nooksack Samish Terminal area for summer fall chinook fisheries to determine presence of adipose clips and CWTs, commencing in 2002 fisheries; (4) Reports on the reduction and analysis of data at such time as these become available in sufficient quantity and quality. **Effectiveness** monitoring addresses the actual proportions of hatchery releases recovered in Nooksack Samish Terminal area fisheries and particularly in areas around the Lummi Reservation. It will first involve data analysis for 2004 fisheries which include CWT recoveries from the Lummi Bay program. Effectiveness of the Lummi Bay program will be based on its recoveries in comparison to the Samish Hatchery fingerling program. **Validation** monitoring will additionally consider the cost of production at Lummi Bay releases and economic and cultural value of the catch to the Lummi Nation.

**Indicator 2. Annual production numbers for release at 90 to 100 per pound in late May in Lummi Bay and the tidally-influenced portion of the lower Nooksack River.**

**Implementation** monitoring will be to confirm that weight-counts have been taken in the final rearing stage before release to estimate size and numbers of release. This procedure should occur with the 2001 release. **Effectiveness** monitoring will be a comparison of the size and numbers of chinook released each year to the release goal for that year and should commence with the 2001 release. **Validation** monitoring will include a measure of central tendency (average) and variation (standard deviation) related to years of release.

**Indicator 3. Adequate escapement and retention of brood stock for the Lummi Bay Hatchery program to realize self-sufficiency in production within 8 years.**

**Implementation** monitoring will consist of initiating and maintaining summer fall chinook brood return records by number, sex, and date, adipose fin clipped and or/CWT. **Effectiveness** monitoring will be a comparison of the numbers, size and dates of the annual returns to determine if progress is being made toward the self sufficiency target. **Validation** monitoring will be description of trend, or of average and a measure of variability for the years through 2008 to determine feasibility.

**Standard B. Avoid substantial negative ecological and genetic interactions with listed fish. Indicators to meet this standard are predicated on an understanding that: (1) habitat**

carrying capacity has been reduced through elimination of habitat and degradation of remaining habitat; and (2) data are presently inadequate to evaluate either the fate of hatchery releases or impacts to natural populations.

**Indicator 1. Substantial co-occurrence of hatchery program fish (all hatcheries) with listed fish on the spawning grounds, in the smolt out-migration, and in near-shore marine habitats commencing in 2002.**

**Implementation** monitoring will be reports of the observations, locations and dates of spawning ground surveys, the observations, locations and dates of operation of smolt-trap operations; and the observations, locations and dates, and gear types for near-shore marine samples. The former two types of studies have been on-going for a number of years; contingent on available funding the near-shore marine component will also be included. These activities will be conducted according to agreed co-manager plans established prior to implementation, developed in consideration of best available science and the results of previous work. The spawning ground sampling should not have much potential for direct or indirect take. The smolt trap capture may result in direct mortalities of listed fish. Its operation and potential take effects are addressed elsewhere. **Effectiveness** monitoring will consist of reports of the numbers of hatchery program, Lummi Bay releases, and natural fish collected at the stated life history stages. **Validation** monitoring will be periodically updated interpretations of the relationship of co-occurrence information based on the generic studies planned under Indicator 3.

**Indicator 2. Substantial co-occurrence of Lummi-Bay releases with fish on the spawning grounds, in smolt out-migration and in near-shore marine environments commencing in 2004.**

**Implementation** monitoring will be reports of the locations and dates of spawning ground surveys, the locations and dates of operation for smolt-trap operations; and the locations and dates, and gear types for near-shore marine samples. The former two types of studies have been on-going for a number of years; contingent on available funding the near-shore marine component will also be included. Adult sampling is not expected to result in direct or indirect take. Sampling of juveniles may result in take. Since the programs are of a more general nature (i.e., not specifically related to hatcheries) these issues are addressed elsewhere. **Effectiveness** monitoring will consist of reports of the numbers of hatchery program, Lummi Bay releases, and natural fish collected at the stated life history stages and comparisons between groups with respect to abundance, size and condition. **Validation** monitoring will use the results of studies that have been funded (Indicator 3) to update our understanding of the relationship of the co-occurrence data to predation, competition, and genetic diversity interactions between Lummi Bay Hatchery chinook and naturally spawned chinook. monitoring Indicator 3.

**Indicator 3. Better definition of potential interactions between Lummi Bay Hatchery releases and through research and monitoring studies at both generic and local population level based on co-occurrence of specific life stages of hatchery and naturally-produced fish**

**contingent on funding.**

**Implementation** monitoring will involve proposals for project funding, and projects funded, which have a direct bearing on hatchery/naturally spawned chinook interactions. Monitoring would be for those proposals and projects submitted or performed by the Lummi Nation;

**Effectiveness** monitoring will be description, using best available science, of those interactions described by the studies, as related to co-occurrence data derived from Indicators 1 and 2.

**Validation** monitoring will test hypotheses related to the impact of described interactions on the capacity, abundance and diversity of listed species.

**Standard C. Develop and maintain an effective brood stock program which avoids new risks to the recovery of listed stocks within 8 years.**

**Indicator 1. Recovery of adequate quantities and qualities of brood stock to meet production to release goals as indicated by an increase in returns of program fish to the hatchery consistent with program and facility modifications;**

**Implementation** monitoring will be annual documentation of the returns of hatchery program fish to the Lummi Bay brood capture facilities. **Effectiveness** monitoring will be a tracking of the numerical trend in return by sex and size, and the average return per year from the 2001 brood forward and evaluation of hatchery modifications on this trend. **Validation** monitoring will be a comparison of returns over the first eight years of the program to assess feasibility for continuing the program.

**Indicator 2. Adherence to co-manager spawning guidelines for selection, mating, and incubation;**

**Implementation** monitoring will document the records of spawning procedures in compliance with the guidelines, e.g., random mating, use of jacks, care of gametes, etc.

**Effectiveness** monitoring will assess the mortality and condition of spawning adults, eggs, and fry within the developing program. **Validation** monitoring will be an assessment of spawning level, egg mortality, and fry production over the eight year period.

**Indicator 3. Use of carcasses to supplement ecosystem nutrients consistent with co-manager approved protocols.**

**Implementation** monitoring will be documentation of the disposition of carcasses of all brood stock captured by the program whether used as brood stock or not. **Effectiveness** monitoring will be an assessment of how well the carcass disposition meets the approved protocols; and **Validation** monitoring will be an assessment of contribution to the organic nutrients of the Nooksack Basin used by natural origin spawners by location over the 8-year period.

#### **Standard D. Avoid Over-Harvest of Listed Stocks.**

**Indicators are predicated on co-manager guidelines (see Section 3.)** The Co-Manager harvest management plan for Nooksack fall chinook has taken into consideration the overlap which might occur with late migrating fish from the North Fork and South Fork chinook stocks which require protection and early migrating fall chinook from the hatchery production which could be harvested. The opening of the fall fishery has been deferred until the first week of August to protect native stocks until such time as a selective fishery which might take hatchery chinook without harm to native chinook can be developed, or until such time as the native chinook can tolerate the exploitation rates which might occur during this overlap.

**Indicator 1.** The August start date for the chinook fisheries, after the reported time of upstream migration of listed Native Char, in addition of the 6+ -inch minimum gill net restriction should eliminate and incidental catch of the listed Native Char.

**Indicator 2.** By-catch of listed species within limits established in the annual harvest management plan.

#### **Summary of Monitoring Efforts for Which Take Exemption is Sought**

**1. Monitoring of In-Hatchery Condition and Mortality** is necessary to meet the **Performance Indicator** for development of a self-sufficient brood program at Lummi Bay within 8 years. This program does not involve listed species and **will not result in the take of listed species.** The Lummi Nation plans to upgrade its hatchery data management system based on emerging hatchery soft-ware (**HatPro**). It is anticipated that the within hatchery monitoring will include at least the following:

Target	Frequency	Methods
<b>Brood Return</b>	Daily	Physical condition (e.g., flow) from protocol Species, numbers, date
<b>Brood Holding</b>	At transfer (Daily)  (Weekly)	Numbers by species, size, sex, marks (fresh/salt?) Water/volume/measured flow/time Temperature at inlet Disease/condition/mortality observations Dissolved Oxygen
<b>Spawning</b>	Daily	Clearly written protocol Numbers of each sex Disposition (e.g., spawned, returned to holding, discarded) Head codes and species, sex, date, disposition
<b>Incubation</b>	Daily at activity Weekly	Dates for: fertilization, bumping, chemical treatments, picking, eyed stage, button-up. Water flow, dissolved oxygen, temperature
<b>Rearing</b>	At transfer Daily  Weekly At activity	Weight-counts, disease/condition/mortality obs. Water flow, temp. Mortality, deviation from protocols, weight of food D.O., weight counts Pathologist exams, marks applied, chemical treatments
<b>Release</b>	At release	All co-mgr. Forms filed; date, location, type of release, transport type and time, result of last weight count, water temperature

**2. Survey of Hatchery Contribution to Fisheries** is necessary to determine the cost effectiveness of hatchery operations, an identified **Performance Indicator** for the Lummi Bay Hatchery. The planned surveys are of adult chinook caught in fisheries and **do not result in take of listed species.** Marks are applied only to non-listed Chinook and **marking does not result in take of a listed species.**

Salmon Co-Managers (Lummi Nation, Nooksack Tribe, and Washington Department of Fish and Wildlife) have agreed to mass mark all hatchery Chinook releases originating in Lummi Bay and the Samish River by removal of the adipose fin. This mark identifies Chinook as hatchery fish only; hatchery chinook from other facilities in Puget Sound have also been mass marked with an adipose fin clip. Commencing with 2001 releases, 200,000 Lummi Bay Hatchery Chinook (20% of total projected release) will receive coded-wire tags (CWTs) in two tag groups. One tag group of 100,000 will identify Lummi Bay hatchery releases and the other tag group of 100,000 will identify off-station releases. The Samish Hatchery also provides CWTs to 200,000 of its Chinook releases.

- **Protocols include:**

- Marking - adipose fin clip of all hatchery releases funded by WDFW per court order and implemented through contractual arrangements using an automated mass marking facility;
- Marking – insertion of Coded-Wire Tags in 200,000 of the Lummi Bay Hatchery release. Tags and marking will be funded in 2001 through the tribal Hatchery Reform Program; in future years contingent upon acquisition of funds by the Lummi Nation. Tags placed using Northwest Indian Fisheries Commission tagging protocols and facility.

Fishery Mark Surveys – Salmon Co-Managers are responsible for sampling the fisheries at a 20% level to estimate CWT contributions to the catches. Pilot Studies in 2001 will seek to improve the resolution of the distribution of CWT recoveries in the Nooksack-Samish terminal area catches. This will ensure the appropriate methodologies are available to demonstrate that Lummi facilities chinook production is achieving the desired contributions to fisheries when the CWTs applied in 2001 releases return.

**3. Spawning Ground surveys** collect information essential to assessing abundance of salmonids for management purposes. Naturally spawning hatchery populations are a part of the abundance information essential for determining exploitation rate in fisheries, and the general performance of fisheries management programs. Because “early” and “late” Chinook are in separate Management Units (MU), there is also an essential requirement to define abundances for early and late stocks. Surveys by the Lummi Nation are a part of a co-operative effort by the watershed’s salmon co-managers, including the Nooksack Tribe and the Washington Department of Fish and Wildlife. Expansions in the scope of on-going program studies with Lummi participation is contingent upon acquisition of sufficient funding.

- **In this HGMP**, one **Performance Indicator** identifies cost-effective contribution to fisheries; another identifies minimizing impacts on listed fish. To address the second performance indicator, additional objectives of escapement surveys are to determine to what extent co-occurrence of hatchery-origin spawners may exist with natural origin spawners throughout the anadromous range in the Nooksack basin.
  - **This co-occurrence**, should it exist, is important because of the potential negative interactions between returning hatchery-origin adults with natural-origin adults, including:
    - Competition for spawning space as exemplified by super-imposition of existing early Chinook redds by redds constructed later by hatchery-origin fish.
    - Potential spawn timing over-laps which could result in mating of hatchery-origin and natural-origin Chinook and resultant genetic impacts;
    - Potential competition for space and food by hatchery-origin and natural-origin Chinook fry and fingerlings;
    - Potential predation by hatchery-origin Chinook fingerlings on natural-origin fry.
  - **Protocols in WRIA 01** in which the Lummi Nation is, or may become, involved include:



- Foot and Boat surveys over the anadromous range of salmonids in WRIA 01, including the Nooksack Basin and adjacent independent drainages. These surveys include:
  - Counting and marking Salmon redds;
  - Counting live adult salmonids;
  - Counting and taking tissues from Salmonid carcasses;
  - Reading of Otolith and CWT marks;
  - Analysis of tissues for comparison to DNA baseline;
  - Survey dates ranging from mid-July through December.
 For Chinook, the following surveys are presently planned for 2001:

<b>DRAINAGE</b>	<b>NUMBER OF REACHES</b>	<b>FREQUENCY</b>	<b>DURATION</b>
Lower Mainstem	5	1-12	July 27-Oct 31
South Fork	4	1-4	“
Middle Fork	3	1-6	“
North Fork	8	1-10	“
Samish River	2	1	“

- **Take of listed fish has not been documented to the present date.** Surveys are of adult fish and their nests are conducted in a manner to, avoid direct take issues.
- **Measures taken to avoid take** include the following, i.e.,
  - Surveyors carefully make visual observations before entering streams, and while wading in streams, to avoid stepping on, or in close proximity, to redds;
  - Surveyors take prudent measures (keep distance, avoid throwing objects) to avoid disturbance of fish on, or near, redds or chinook engaged in nest-building and spawning activities;
  - Should suspected take occur in the future, the co-managers will develop modifications of the spawning ground surveys in consultation with NMFS Science Branch to reduce or eliminate incidental take without jeopardizing the value of the spawner estimate..

**4. Monitoring Smolt Out-Migration.** Monitoring smolt out-migration, in concert with spawning ground monitors, is essential for estimation of fresh-water survival and production of natural-origin Chinook, and potential hatchery impacts thereon by virtue of co-occurrence in the fresh-water system. Smolt out-migration in the Nooksack is monitored by two rotary screw traps (MacKay, 2000). One trap is located on the South Fork Nooksack River and a second is operated on the lower Mainstem. The Lummi Nation and Nooksack Tribe cooperate in operation of the traps. The Nooksack Tribe is the Lead Agency for operation of the South Fork trap and

the Lummi Nation is the Lead Agency for operation of the lower Mainstem trap. Tribes have obtained funding from Public Utility District No. 1 of Whatcom County, the Pacific Salmon Commission, and the Governor's Salmon Recovery Office for operation of the traps in past years. The Lummi Nation will use a portion of Department of Commerce Tribal Endangered Species Act funding to operate the lower Mainstem trap in 2001. Operation of the traps **does carry with it the potential for take of listed species.** This HGMP seeks exemptions for the take based on the over-riding benefits to salmon recovery. Detailed methods of operation, efficiencies, and catches are reported in MacKay, 2000).

- **Protocols for the trap operations include:**
  - Operation of two floating screw traps on the South Fork River at RM 1.0 and Mainstem RM 4.7 between January and September each year;
  - Traps have opening of 2.43 meters (diameter) and half-submerged sampling depth of 1.2 meters;
  - Traps are operated on a stratified random schedule to encompass some of the major variables influencing effectiveness of capture (e.g., day-light, turbidity, flow) while retaining cost-effectiveness of operation;
  - Relative abundance of out-migration is based on trap operation efficiency studies;
  - Catch is classified by species and, in the case of Chinook, by sub-population;
  - Sub-population identification is derived from a variety of information sources including (e.g., hatchery marks, analysis of tissue sub-samples for DNA, size, relation to release patterns); there is a protocol for continuing improvement in this identification.
- **Estimation of Take based on Past Operation.** At present, the estimation of take by the smolt out-migrant studies are based on past operations. It is important to understand that stock contributions as a percentage will not reflect expected contributions in the future because major changes in hatchery production of salmon have occurred over the most recent years. These include: (1) Nooksack Late Chinook (i.e., Mainstem Nooksack Samish Chinook in WDF, et al 1993) are no longer released above the lower trap location; (2) Nooksack Coho (released from the Lummi Nation's Skookum Creek Hatchery and WDFW North Fork Nooksack Hatchery) now have greatly reduced numbers of release (down to approximately 1,300,000 from targets in excess of 6,000,000).

Composition of catch in the Mainstem trap for 1999 (Young and Shaklee, 1999) was as follows:

<b>Stock</b>	<b>Estimated by</b>	<b>Contribution</b>
South Fork Nooksack early	No mark, plus DNA sub	4.4%
North Fork Nooksack early	CWT Mark, plus DNA sub	83.2%
Nooksack Samish late	CWT Mark, plus DNA sub	12.4%

All chinook smolts caught in the South Fork trap are of natural origin except those used to experimentally determine trap efficiency. The trap operated only in 2000 and caught a total of 1,821 unmarked smolts. DNA analysis of tissues has not yet been completed.

A summary of juvenile Chinook mortality in the lower Mainstem trap, 1994-2000 (MacKay, 2000).

Year	Number of Mortality	Total Catch	Percent Mortality
2000	34	10636	0.3%
1999	11	4049	0.3%
1998	0	2329	0.0%
1997	12	2742	0.4%
1996	11	4765	0.2%
1995	22	3163	0.7%
1994	674*	3860	17.5%

Mortality has been much less than 1% of the total catch in each year of operation since 1995. Because of the small cross-section of the traps relative to river cross section, percentage of total out-migrant numbers is extremely small. Efficiency estimates of trap operating indicate that only 0.1% to 5.6% of the chinook passing the trap location are captured. The total take in terms of AEQ are minimal with adult survival estimated at 0.003.

**11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.**

Under the Department of Interior's program for Self-Governance Tribes, the Lummi Nation operates a large core natural resources program.. Lummi also has many specific resource-related projects funded from a variety of other sources. These include federal grants and contracts with BIA, BOR, NMFS, USGS, USFWS and EPA; state grants and contracts with State DOE, WDFW, DNR, IAC, grants from private foundations, and revenue-generating activities of the tribe.

The Lummi Nation Natural Resources Department has approximately 40 permanent positions, plus additional seasonal and temporary staff. The majority of the staff have advanced degrees in the natural sciences, with backgrounds in wildlife biology, ecology, zoology, forestry, geomorphology, hydrology, fisheries, and management. There is a great amount of professional experience and local knowledge amongst the staff. Approximately 3 FTE s are devoted to

developing and tracking funding sources for Natural Resources projects.

In addition to Natural Resources Department personnel, there are well-staffed ancillary departments, such as GIS and Planning, Employment and Training Center, Lummi Nation Archives, Enforcement, Grants and Contracts Officer, and Accounting.

Sufficient funding and expertise is available to conduct monitoring and evaluation programs at minimal levels and past experience suggests that well crafted proposals to assess the status of listed stocks in the Nooksack and the progress of recovery efforts will be funded at levels which will allow the best available science to prevail.

**11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.**

The majority of monitoring and evaluation activities do not take place in the stream environment, and thus have no adverse genetic or ecological effects on listed fish. Risk aversion measures for four larger projects that may have a potential for adverse effects are listed below. Take exemptions for these activities are provided under other provisions of NMFS (2000)..

- **Smolt Trap - This trap, located in the lower river, is used to monitor smolt out-migration including both hatchery smolts and naturally-produced smolts. Application for take exemption is through the tribal research and monitoring provisions provided by Sections 7 and 4(d) in NMFS (2000).**
- **Nooksack basin spawner surveys** Surveys by the co-managers are for multiple purposes including estimation of escapement for naturally-produced and hatchery fish and providing co-occurrence data from which to evaluate potential interactions. Application for exemption from take will be provided under Sections 7 and 4(d) of NMFS (2000).

## **SECTION 12. RESEARCH**

A Performance Indicator for this HGMP is lack of substantial negative interactions of hatchery Chinook with listed Chinook. In Section 11, we addressed monitoring of co-occurrence of adult Chinook on the spawning grounds and monitoring of juvenile Chinook as smolt out-migrants. Although present science has suggests potential negative ecological interactions between hatchery and naturally produced Chinook in other geographic locations and habitat conditions, data specific to these interactions in the Nooksack basin are lacking. A first step in identifying the potential for inter-population and inter-species interactions in this system is to determine co-occurrence of these fish in fresh-water, estuarine, near-shore and near by offshore habitats. A

second step is determining the changes in distribution and abundance of the two groups of Chinook over time in each of the habitats investigating differences in condition, food consumed, growth rates, and migration timing in each of the above mentioned habitats.

The following represent research topics that will be aggressively pursued by the Lummi Nation, either alone or in cooperation with Salmon Co-Managers. Appropriate protocols will be developed, in consultation with the NMFS Science Branch, to ensure maximum information on the ecological interactions between hatchery and naturally spawned Chinook with minimum acceptable take of listed chinook.

1. Co-Occurrence in Nooksack River estuarine, and near-shore and off shore brackish marine habitats from Point Williams to Point Whitehorn.
2. Change in size and condition of co-occurring hatchery and naturally spawned Chinook in estuarine, near shore and off shore brackish marine habitats from Point Williams to Point Whitehorn.
3. Comparison of the stomach contents of co-occurring hatchery and naturally spawned Chinook in estuarine, near shore and off shore brackish marine habitats from Point Williams to Point Whitehorn.
4. Comparison of the growth rates of co-occurring hatchery and naturally spawned Chinook in estuarine, near shore and off shore brackish marine habitats from Point Williams to Point Whitehorn.
5. Changes in the distribution and abundance of co-occurring hatchery and naturally spawned Chinook in estuarine, near shore and off shore brackish marine habitats from Point Williams to Point Whitehorn.

## **SECTION 13. ATTACHMENTS AND CITATIONS**

### **PERSONAL COMMUNICATIONS**

Mike MacKay	Fisheries Biologist, Lummi Nation Natural Resources Department.
Bob Hall:	Hatchery Manager, Lummi Bay Hatchery, Lummi Nation Natural Resources Department.
Ted Tygeson	Manager, Nooksack River Hatchery Complex, Washington Department of Fish and Wildlife

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#### **SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY**

“I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for

the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.”

Name, Title, and Signature of Applicant:

Merle Jefferson  
Executive Director  
Lummi Natural Resources

Certified by \_\_\_\_\_ Date: \_\_\_\_\_

